

Inferring PSC Composition in the Arctic from UARS MLS HNO<sub>3</sub> and  
POAM II Aerosol Extinction Measurements

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We examine UARS Microwave Limb Sounder (MLS) observations of gas-phase HNO<sub>3</sub> together with Polar Ozone and Aerosol Measurement (POAM) II observations of aerosol extinction to investigate the composition of the polar stratospheric clouds (PSCs) that formed during the northern hemisphere winter of 1995/1996. This winter was the coldest, the most persistently cold, and cold over the largest geographical area, of any northern winter in the last two decades, and it was characterized by the largest number of PSC detections in the POAM II Arctic PSC database. An overview of the evolution during this winter of the observed aerosol extinction and HNO<sub>3</sub> in the lower stratosphere is obtained by mapping these data sets (along with temperatures from the United Kingdom Meteorological Office data assimilation system) into equivalent latitude/potential temperature space. We further examine in detail the relationship between the observed HNO<sub>3</sub> and aerosol extinction as a function of temperature during individual PSC events. The observed behavior of both HNO<sub>3</sub> and aerosol extinction is compared to that predicted using various models of PSC composition, including nitric acid trihydrate, nitric acid dihydrate, and supercooled ternary solutions. Air parcel trajectories are calculated both forward and backward from the locations of POAM PSC detections, and the observed and modelled HNO<sub>3</sub> and aerosol extinction values are compared at points along the trajectories in the days both preceding and following a PSC episode. This approach allows the variations in gas-phase HNO<sub>3</sub> and aerosol extinction to be tracked during PSC dissipation as well as formation, possibly providing greater insight into the governing thermodynamics.

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